(4) Continuation of the rain ingestion during subsequent rapid acceleration to takeoff power.

(c) *Engines for supersonic airplanes.* In addition to complying with paragraphs (a)(1) and (a)(2) of this section, a separate test for supersonic airplane engines only, shall be conducted with three hailstones ingested at supersonic cruise velocity. These hailstones shall be aimed at the engine's critical face area, and their ingestion must not cause unacceptable mechanical damage or unacceptable power or thrust loss after the ingestion or require the engine to be shut down. The size of these hailstones shall be determined from the linear variation in diameter from 1-inch (25 millimeters) at 35,000 feet (10,500 meters) to ¼-inch (6 millimeters) at 60,000 feet (18,000 meters) using the diameter corresponding to the lowest expected supersonic cruise altitude. Alternatively, three larger hailstones may be ingested at subsonic velocities such that the kinetic energy of these larger hailstones is equivalent to the applicable supersonic ingestion conditions.

(d) For an engine that incorporates or requires the use of a protection device, demonstration of the rain and hail ingestion capabilities of the engine, as required in paragraphs (a), (b), and (c) of this section, may be waived wholly or in part by the Administrator if the applicant shows that:

(1) The subject rain and hail constituents are of a size that will not pass through the protection device;

(2) The protection device will withstand the impact of the subject rain and hail constituents; and

(3) The subject of rain and hail constituents, stopped by the protection device, will not obstruct the flow of induction air into the engine, resulting in damage, power or thrust loss, or other adverse engine anomalies in excess of what would be accepted in paragraphs (a), (b), and (c) of this section.

[Doc. No. 28652, 63 FR 14799, Mar. 26, 1998]

§ 33.79 Fuel burning thrust augmentor.

Each fuel burning thrust augmentor, including the nozzle, must—

(a) Provide cutoff of the fuel burning thrust augmentor;

(b) Permit on-off cycling;

(c) Be controllable within the intended range of operation;

(d) Upon a failure or malfunction of augmentor combustion, not cause the engine to lose thrust other than that provided by the augmentor; and

(e) Have controls that function compatibly with the other engine controls and automatically shut off augmentor fuel flow if the engine rotor speed drops below the minimum rotational speed at which the augmentor is intended to function.

[Amdt. 33–6, 39 FR 35468, Oct. 1, 1974]

Subpart F—Block Tests; Turbine Aircraft Engines

§ 33.81 Applicability.

This subpart prescribes the block tests and inspections for turbine engines.

[Doc. 3025, 29 FR 7453, June 10, 1964, as amended by Amdt. 33–6, 39 FR 35468, Oct. 1, 1974]

§ 33.82 General.

Before each endurance test required by this subpart, the adjustment setting and functioning characteristic of each component having an adjustment setting and a functioning characteristic that can be established independent of installation on the engine must be established and recorded.

[Amdt. 36–6, 39 FR 35468, Oct. 1, 1974]

§ 33.83 Vibration test.

(a) Each engine must undergo vibration surveys to establish that the vibration characteristics of those components that may be subject to mechanically or aerodynamically induced vibratory excitations are acceptable throughout the declared flight envelope. The engine surveys shall be based upon an appropriate combination of experience, analysis, and component test and shall address, as a minimum, blades, vanes, rotor discs, spacers, and rotor shafts.

(b) The surveys shall cover the ranges of power or thrust, and both the physical and corrected rotational speeds for each rotor system, corresponding to operations throughout the range of ambient conditions in the